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VERMICOMPOST IS BOON TO ENRICHMENT OF MICRONUTRIENT CONTENT IN SOIL

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ABSTRACT

Vermicompost is organic manure, also called bio-manure, generally produced from agricultural and household waste products and contain adequate quantity of nutrients for growth. Such wastes are biodegradable and process of decomposing is accelerated with the help of worms such as Earthworms *Eudrilus eugeniae*. In the present study, three different types of agricultural wastes, wheat straw (V1), sugarcane waste (V2) and corn husk (V3), were taken as vermicompost material. The process was carried out in a plastic bin (30 x 20 cm), filled with cow dung and dry leaves. The plastic bin was sprinkled with water at regular intervals and proper aeration is provided to encourage proper breakdown of organic matter. The pH of vermicompost was found to be alkaline. Nutrients like Fe, Cu, Zn and Bo were found in trace amount while P and K were present in higher amount when compared with standard values whereas amount of Organic carbon was comparable with standard range.

KEYWORDS: Eudrilus Eugeniae, Vermicompost, Wheat Straw, Sugarcane Waste, Corn Husk.

INTRODUCTION

Vermicompost is organic fertilizer is developed by animal and plant resources with the help of earth warm. This organic fertilizer has advantage over chemical fertilizer, in case of water logging or excess of water chemical fertilizer drift out from the field and its high and low

concentration may effect on benificial microorganism present in the soil. Prolong exposure of chemical fertilizers can harmed the physiochemical profile of soil and biological nature and it ultimately causes pollution in environment. For ideal growth and enlargement, numerous crucial elements are required by plants and if some component is deficient in the soil, there is a complete inhibition of plant growth.[1] Metabolic enzymes have various micronutrients as their structural component. Some major physiological activity like respiration and photosynthesis majorly required numerous micronutrient metals as a cofactor.[2] In the case of wheat, deficiency of boron drastically reduces its total yield.[3] High amount of chemical fertilizer is required over soil to improve it micronutrient prominence as it is costly compare to organic fertilizer.[4]

Organic compost act as a enrich source of micro, macronutrient and organic carbon, but also increase the microbial diversity in soil, compost directly influence nutrients amount and various other associated factors of the soil.[5] Vermicompost is a natural organic fertilizer having increase amount of organic substance, carbon and N, P, K together with micronutrients.[6,7] Plant easily intake vermicompost material because of their soluble form, due to the presence of humic acid and plant hormone, compost is biologically and enzymatically active material.[7,8] Present study is based on to analyse the impact of different types of vermicompost {Wheat straw (V1), Sugarcane waste (V2) and Corn husk (V3)} into micronutrient content of soil.

MATERIAL AND METHODOLOGY

The study involved the analysis of waste composition from agriculture waste. The waste was collected from different regions of Dehradun in the form of wheat straw (V1), sugarcane waste (V2) and corn husk (V3). The experimental setup includes the usage of plastic bin for V1,V2,V3.

Collection of material: Soil sample were collected from Uttaranchal University campus. The cow dung (20 days old) was collected from nearby dairy farms. The moisture of the medium should be maintained at about 50% -75% and the agricultural waste was also collected from the nearby dairy farm, Farmers and vegetable shop keeper.

Earthworms: Earthworms *Eudrilus eugeniae* was chosen for making vermicompost. Earthworms *E.eugeniae* was bought from local market Niramaya vermicompost centre, Dehradun.

Organic waste

In this study wheat straw, sugarcane waste and corn husk were used as organic waste to feed earthworms.

Decomposing

A plastic bin (30 x 20 cm) was filled with a mixture of cow dung and dry leaves. Water was sprinkled regularly over the container (containing organic mixture) so that it can decompose easily and it was turn up and down for proper aeration and promote breakdown of organic matter. This process was carried for 15 successive days.

Composting

In this process decomposed organic mixture of cow dung and agricultural waste was filled in a plastic bin container. Mature earthworms were uniformly released on the top of the all 3 experimental containers. The experiment was conducted at laboratory of Uttaranchal University. The container was daily observed to check the necessary parameters required for survival and reproduction of earthworms. vermicompost was analysed for different physio-chemical characters such as pH, organic carbon (OC), nitrogen, phosphorous, potassium, calcium, manganese, iron, copper, zinc, boron, electric conductivity (EC).[9,10,11]

RESULTS AND DISCUSSION

In the present study, 3 different type of agricultural wastes were analyzed in the form of wheat straw (V1), sugarcane waste (V2) and corn husk (V3) to determine their physiochemical characteristics as vermicompost. The collected agricultural waste was decomposed and vermicomposited with the help of Earthworms (*Eudrilus eugeniae*) in the presence of optimum moisture provided in a Plastic bin **(Figure 1)**.

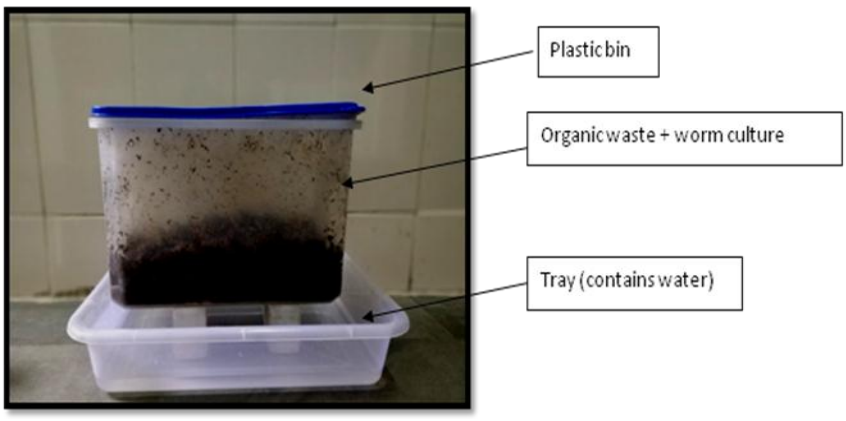

Figure 1: Small scale setup of vermicomposting unit.

The pH was found in normal range as per standard values, also, Nutrients including Fe, Cu, Zn and Bo were found in trace amount where as P and K were in higher amount as compared to standard values but Organic carbon value was according to standard range **(Table 1)**.

Table 1: Comparative analysis of soil parameter in different vermicompost samples.

Nutrients	Control soil	V1	V2	V3	Standard Values
Colour	Brown	Black brown	Brown	Brown	-
Odour	-	yes	yes	yes	-
pH	8.63	7.54	8.13	7.60	6.5 to 8.5
Electric conductivity	0.14	0.54	0.49	0.03	Less than 1 ms/cm
Phosphorus (P)	19.8	64.9	105.6	167.2	Less than 1%
Potash (K)	57.0	2216	1800	8599	Less than 1%
Calcium (Ca)	-	-	-	-	-
Sulphur (S)	8.00	57.60	55.35	169.34	-
Magnesium (Mn)	1.29	2.95	21.10	20.02	-
Iron (Fe)	2.89	17.37	26.96	1.87	Ranging up to 860 mg /kg
Copper (Cu)	0.35	1.10	2.18	0.99	Ranging up to 300 mg/kg
Zinc (Zn)	0.42	3.32	3.02	6.86	Ranging up to 400
Boron (Bo)	0.62	1.82	1.04	5.75	Ranging up to 290
Organic carbon	0.29	2.33	2.16	5.29	Less than 18%

V1 = Wheat straw V2 = Sugarcane V3 = Corn leaves.

Wheat straw (V1) is used as manure and is easily available due to its no utility after Harvest and Threshing. Similarly, Sugarcane (V2) and Corn Husk (V3) are used as manure in agricultural fields as they do not have any other specific utility value and are biodegradable with some nutritive content which is increased by decomposing and vermicomposting. Wheat Straw (V1) and Corn Husk (V3) take 15 days for decomposing while Sugarcane takes longer time period of 45 days to decomposed and then nearly equal time is needed for vermicompost by all the three vermicompost materials **(Figure 2, 3 and 4)**.

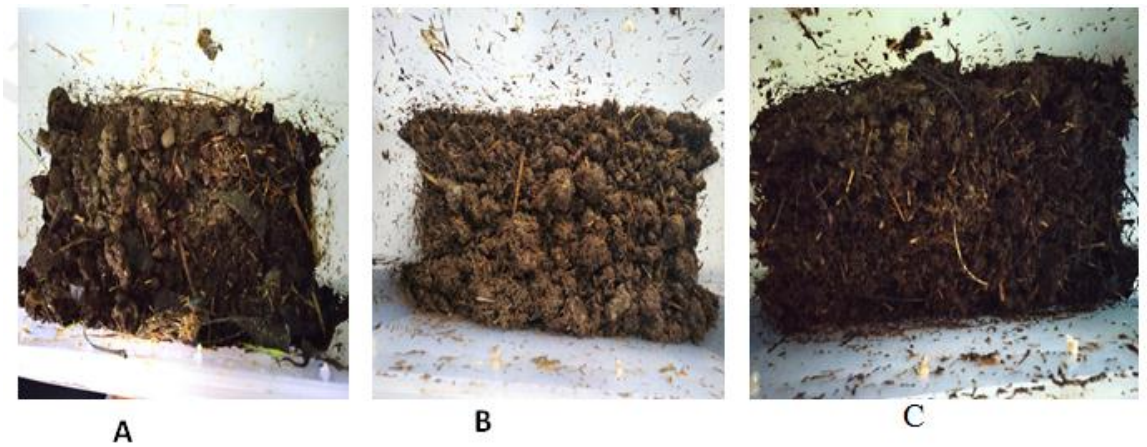

Figure 2: Different stages of vermicomposting using wheat straw, A) Day 1 initial stage (vermicast preparation), B) After 15 days vermicompost is starts decomposing, C) Day 30 the waste is completely degraded by earthworms, D) prepared vermicompost is start drying E) finally vermicompost packed and final product made.

pH values of wheat straw (V1), sugarcane waste (V2) and corn husk (V3) falls under the pH values of control which makes it desirable to use in agriculture as manure (Graph 1). The pH value indicates that all the vermicompost materials are alkaline in nature. Potash (K) requirement in agriculture is in trace amount but agricultural waste, wheat straw (V1), sugarcane waste (V2) and corn husk (V3) are rich in Potash (K) concentration which may disrupts the uptake of other essential nutrients (calcium, nitrogen, magnesium, etc.) and create deficiency which produce visible effects in plant physiology (Graph 2).

Figure 3: Different stages of vermicomposting using sugarcane waste, A) Day 1 initial stage (vermicast preparation). B) After 15 days vermicompost is starts decomposting. C) vermicompost is still decomposing D) Day 45the waste is completely degraded by earthworms. E) The prepared vermicopost is starts drying. F) finally vermicompost is packed and final product is made.

It can be clearly seen from Graph 3 that Sulphur (S) content present in control is in trace amount whereas in vermicompost material wheat straw (V1), sugarcane waste (V2) and corn husk (V3) contain high amount of Sulphur (S). Corn Husk (V3) contain highest amount of Sulphur (S) whereas Wheat Straw (V1) and Sugarcane (V2) contain equal amount of Sulphur (S) in themselves. Similarly, High amount of Zinc (Zn), Boron (Bo) and Organic Carbon (C) is present in Corn Husk (V3) whereas Wheat Straw (V1) and Sugarcane (V2) contain comparably less amount of Zinc (Zn), Boron (Bo) and Organic Carbon (C). Trace amount of Zinc (Zn), Boron (B) and Organic Carbon (C) is present in Control (Graph 7, 8 and 9).

Magnesium content in Wheat Straw (V1) is higher but still comparable with the content of Magnesium (Mg) in control, though, Wheat Straw (V1) and Corn Straw (V3) contain very high content of Magnesium (Mg) (Graph 4).

High Iron (Fe) content is present in Wheat Straw (V1) and Wheat Straw (V1) whereas low amount of Iron (Fe) content is present in Corn Straw (V3) and Control (Graph 5).

Trace amount of Copper (Cu) is present in Control, although, Vermicompost material, straw (V1), sugarcane waste (V2) and corn husk (V3), contain high amount of Copper (Cu), in which sugarcane waste (V2) contain highest amount of Copper (Cu) (Graph 6).

Figure 4: Different stages of vermicomposting using corn waste A) Day 1 initial stage (vermicast preparation). B) After 15 days vermicompost is starts decomposing C) Day 30the waste is completely degraded by earthworms. D) The prepared vermicompost is start drying E) finally vermicompost is packed and final product made.

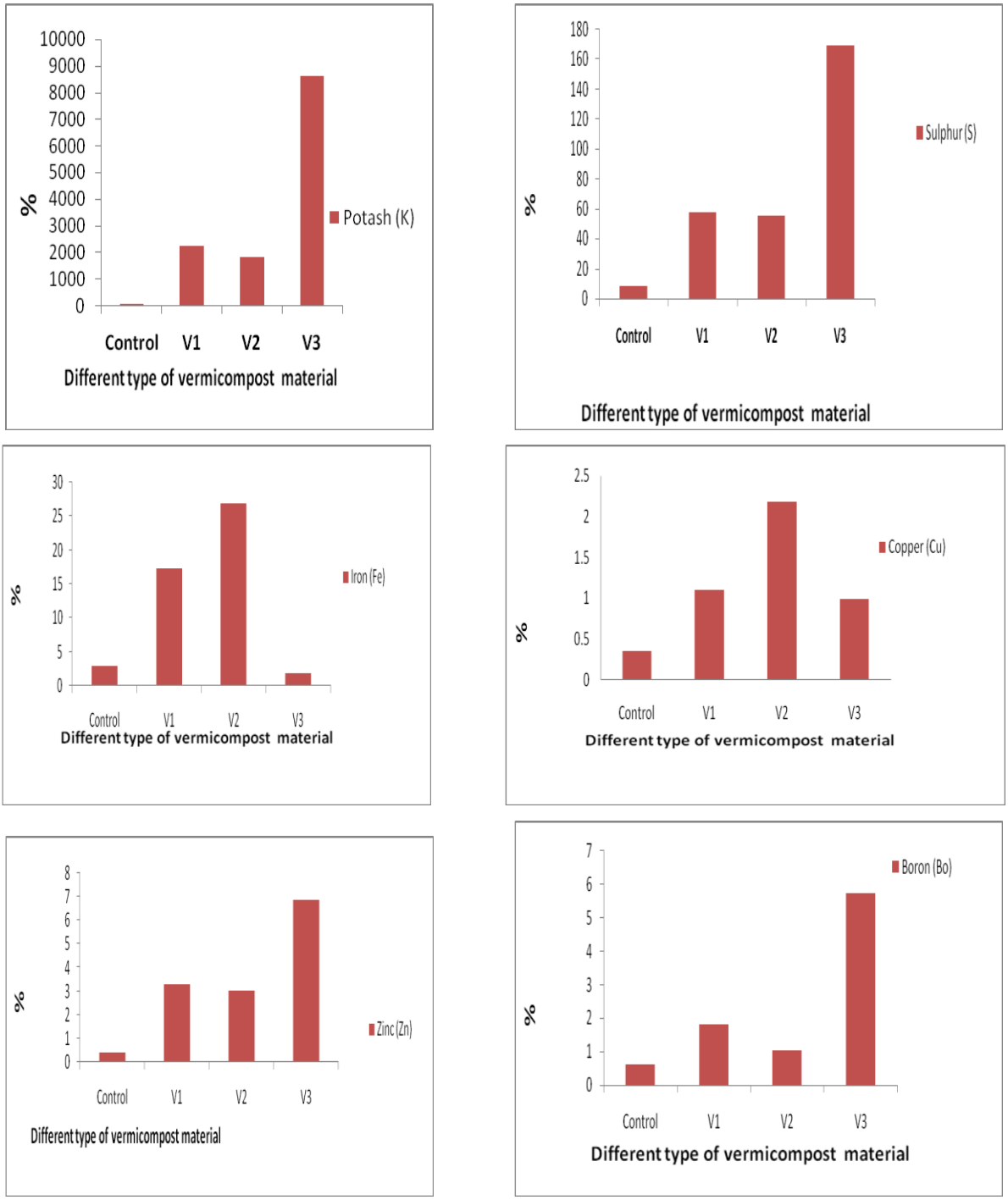

Figure 5: Comparative study of inorganic compound present in vermicompost prepare by different raw material.

Vermicomposting also called Worm composting is a process of organic solid waste conversion into more stabilized dark, earth-smelling soil conditioner and nutrient-rich compost by the help of worms like earthworms which make soil rich major and micronutrients. Enhanced decomposition stabilized the organic matter in the presence of earthworms.[12] Processing or treatment of organic waste needs low cost technology.[13]

Further, it have less soluble salts, greater cation exchange capacity and increased total humic acid contents.[14] Vermicompost is capable of supplying soil with both macro and micronutrients to provide optimum plant growth.[15] Vermicompost is majorly consist of of C, H and O, and It also contain NO3, PO4, Ca, K, Mg, S as macronutrients and some other Micronutrients, which provide similar growth and yield to the plant as by inorganic fertilizers.[16] Due to the humic acids derived from vermicompost, significant amount of N, P, K, Ca and Mg is accumulated in the shoots, roots and leaves.[17] According to a hypothesis, increased earthworm population is responsible for the increment of biologically active substrates such as plant growth regulators.[18]

CONCLUSION

Organic vegetable production is controlled by essential macro and micronutrients and other growth promoting substances present in the growth media. These may be supplied from inorganic and organic sources. With the global trend moving towards the production of organic food crops, organic waste material processed by the naturally occurring earthworm *Eisenia fetida* may be used to produce vermicompost which will supply nutrients and other soil stimulants for plant growth and improve soil quality. Plant growth and quality are enhanced through improved soil quality. It is therefore worthwhile to establish the ideal rate of application of vermicompost in order to achieve this objective. It is beneficial for both environment and agricultural products produced by farming through vermicomposting which are later utilized in numerous sectors of society for human welfare.

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